Radio-absorbing materials with adjustable dielectric properties

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It is known that radio-absorbing materials (RAM) are structural dielectrics that effectively absorb the electromagnetic energy of radio waves. According to the classification, radio-absorbing materials can be magnetic and non-magnetic. In turn, non-magnetic radio-absorbing materials are subdivided into gradient, interference and combined. Gradient RAM have a multilayer structure (see Fig. 1) with a smooth change of the value of dielectric permeability along the thickness of the material $\varepsilon_1 > \varepsilon_2 > \varepsilon_3 > \varepsilon_n$. The first layer of RAM should be made of a material having low dielectric losses (ε_1) in order to match the wave resistance of air and material (for example, celsian and slavsonite). Other layers are made of solid dielectrics with high dielectric permeability (ferroelectrics, ferroelectromagnets and others), and also with the use of magnetic or non-magnetic radio-absorbing fillers, which are introduced into the dielectric matrix (graphite, ferrites and others).

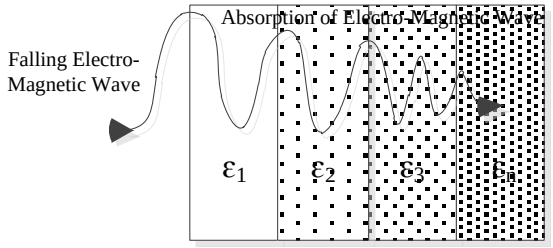

Fig. 1. Schematic view of the gradient radio-absorbing material

The work done allowed to solve the problem of obtaining a ceramic material based on the $SrO–TiO_2–SiO_2$ system (see Fig. 2) with high values of the permeability.

On the basis of the studies carried out, a technology for manufacturing a ceramic material of composition II (SiO_2 – 1.97, TiO_2 – 45.40, SrO – 52.63) with a high dielectric permeability was developed. The technology of manufacturing ceramics based on strontium titanate consisted of two stages. The first stage of synthesis occurred at a maximum temperature of 1300 ºC with holding during 2 hours. The second stage was carried out at a temperature of 1330 ºC with holding for 1 hour. It was found that the composition II has the best indicators (firing temperature 1330 °C), which is located in the triangle Sr_3T_2 – SrT – SrS with the following properties: dielectric permeability ε = 115; water absorption *W*,% – 1.3; open porosity *P*,% –5.8; density ρ, g/cm^3 – 4.35.

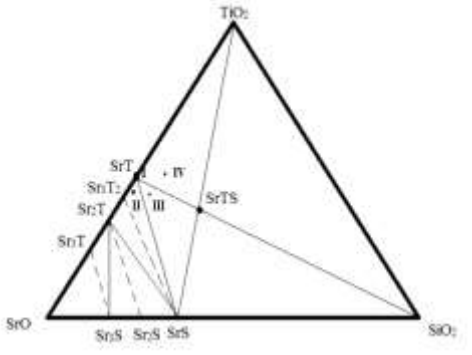

Fig. 2. Diagram of the three-component system $SrO–TiO_2–SiO_2$

The generalization of the obtained data allows to draw a conclusion that the developed composition of the ceramic material on the basis of the three-component system $SrO–TiO_2–SiO_2$ is promising for creating a gradient radio-absorbing material.